

ISO-NE
draft 2019
solar PV
forecast

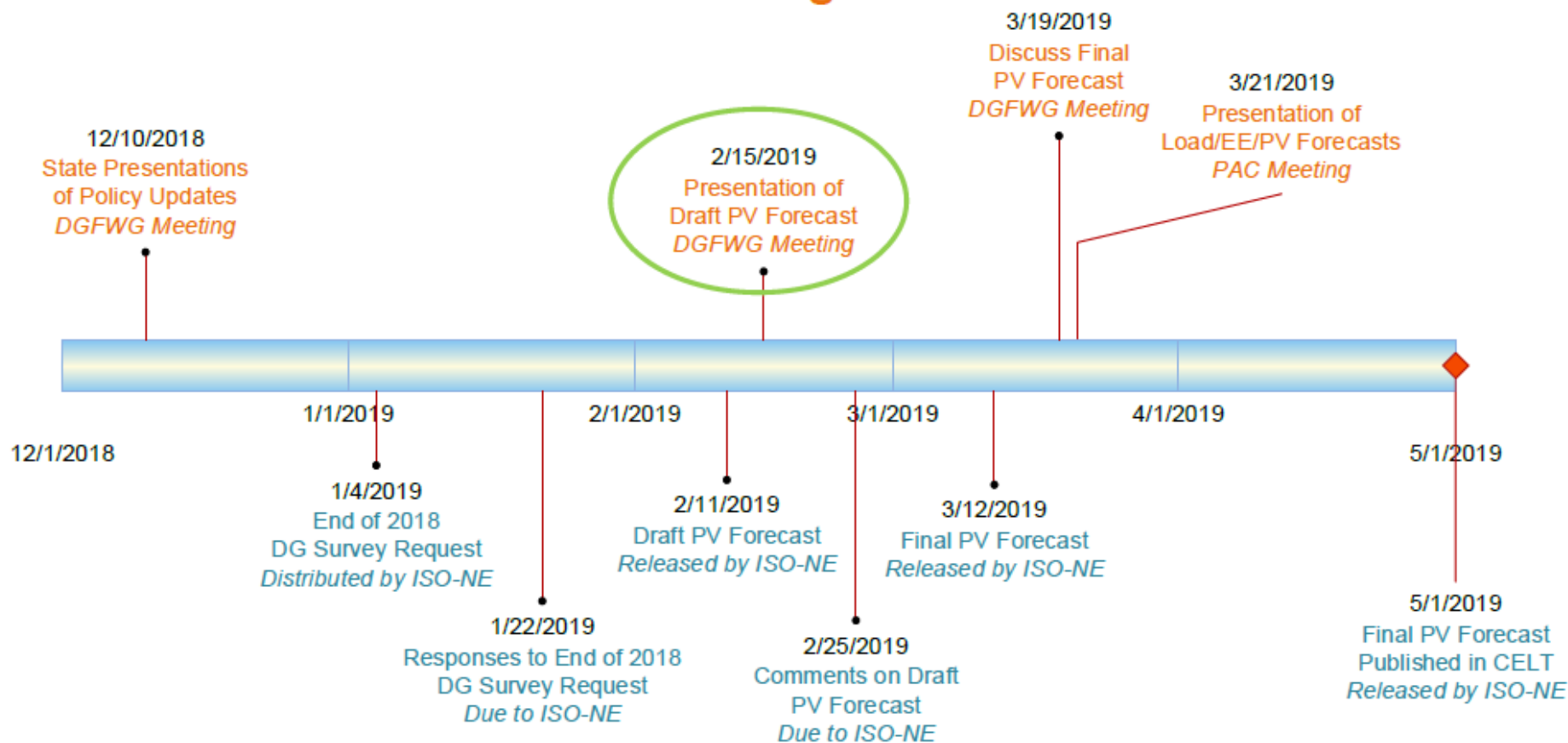
vermont electric power company



February 21, 2019

2019 PV Forecast Schedule

Meetings



Milestones



2018 PV Growth

Total Nameplate Capacity

- Comparison of the state-by-state 2018 PV growth and the reported growth for 2018 reported by utilities is tabulated below
 - Values include FCM, EOR, and BTM PV projects < 5 MW_{ac} in nameplate capacity
- Regionally, 2018 growth reported by utilities totaled 493.3 MW, which is 18 MW higher than the forecast growth
 - Results vary by state

State	2018 Reported Growth	2018 Forecast Growth	Difference
CT	98.7	88.6	10.1
MA	269.0	296.7	-27.7
ME	7.9	10.2	-2.2
NH	14.2	13.8	0.3
RI	54.4	34.5	19.9
VT	49.1	31.5	17.6
Region	493.3	475.3	18.0

Vermont Forecast Methodology and Assumptions



- [VT DPS' 12/10/18 DGFWDG presentation](#) serves as the primary source for VT policy information
- VT Distribution Owner survey results
 - 306.3 MW_{AC} installed by 12/31/18
- DG carve-out of the Renewable Energy Standard (RES)
 - Assume 85% of eligible resources will be PV and a total of 25 MW/year will develop
- Standard Offer Program
 - Will promote a total of 110 MW of PV (of the 127.5 MW total goal)
 - All forward-looking renewable energy certificates (RECs) from Standard Offer projects will be sold to utilities and count towards RES DG carve-out]
- Net metering
 - In all years after 2019 (see below), all renewable energy certificates (RECs) from net metered projects will be sold to utilities and count towards RES DG carve-out, resulting in 25 MW/year as stated above
- For 2019, a total of 35 MW is anticipated in VT, which is in excess of the 25 MW/year due to the RES DG carve-out
 - This reflects expectations that, similar to the past couple of years, PV development will be greater than that needed for compliance with the RES DG carve out for one more year

December 2018 Year-to-Date Installed PV by Distribution Owner

State	Utility	Installed Capacity (MW _{AC})	No. of Installations
NH	Liberty Utilities	3.89	411
	New Hampshire Electric Co-op	10.16	1,008
	Public Service of New Hampshire	60.86	5,978
	Unitil (UES)	8.92	834
	Total	83.84	8,231
RI	National Grid	116.66	5,993
	Total	116.66	5,993
VT	Burlington Electric Department	6.58	253
	Green Mountain Power	253.99	9,294
	Stowe Electric Department	2.41	80
	Vermont Electric Co-op	27.38	1,230
	Vermont Public Power Supply Authority	10.37	535
	VT Other Municipals	0.10	1
	Washington Electric Co-op	5.46	471
	Total	306.30	11,864
New England		2,883.81	157,006

Draft 2019 Forecast Inputs

Pre-Discounted Nameplate Values

States	Pre-Discount Annual Total MW (AC nameplate rating)											Total
	Thru 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
CT	464.3	76.0	101.3	114.7	114.7	84.3	84.3	84.3	84.3	84.3	84.3	1,376.3
MA	1871.3	324.4	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	5,075.7
ME	41.4	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	120.1
NH	83.8	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	225.5
RI	116.7	57.0	57.0	57.0	49.9	49.9	49.9	49.9	49.9	49.9	49.9	636.3
VT	306.3	35.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	566.3
-Discount Annual Policy-Based MWs	2883.8	514.6	503.1	454.6	447.4	417.0	177.0	97.0	97.0	97.0	97.0	5,785.2
-Discount Annual Post-Policy MWs	0.0	0.0	22.3	84.3	84.3	84.3	324.3	404.3	404.3	404.3	404.3	2,216.5
-Discount Annual Total (MW)	2883.8	514.6	525.4	538.8	531.7	501.2	501.2	501.2	501.2	501.2	501.2	8,001.7
-Discount Cumulative Total (MW)	2883.8	3,398.4	3,923.8	4,462.6	4,994.2	5,495.5	5,996.7	6,497.9	6,999.2	7,500.4	8,001.6	8,001.6

Notes:

- (1) The above values **are not the forecast**, but rather pre-discounted inputs to the forecast (see slides 20-26 for details)
- (2) Yellow highlighted cells indicate that values contain post-policy MWs
- (3) All values include FCM Resources, non-FCM Settlement Only Generators and Generators (per OP-14), and load reducing PV resources
- (4) All values represent end-of-year installed capacities

Draft 2019 PV Forecast

Nameplate Capacity, MW_{ac}

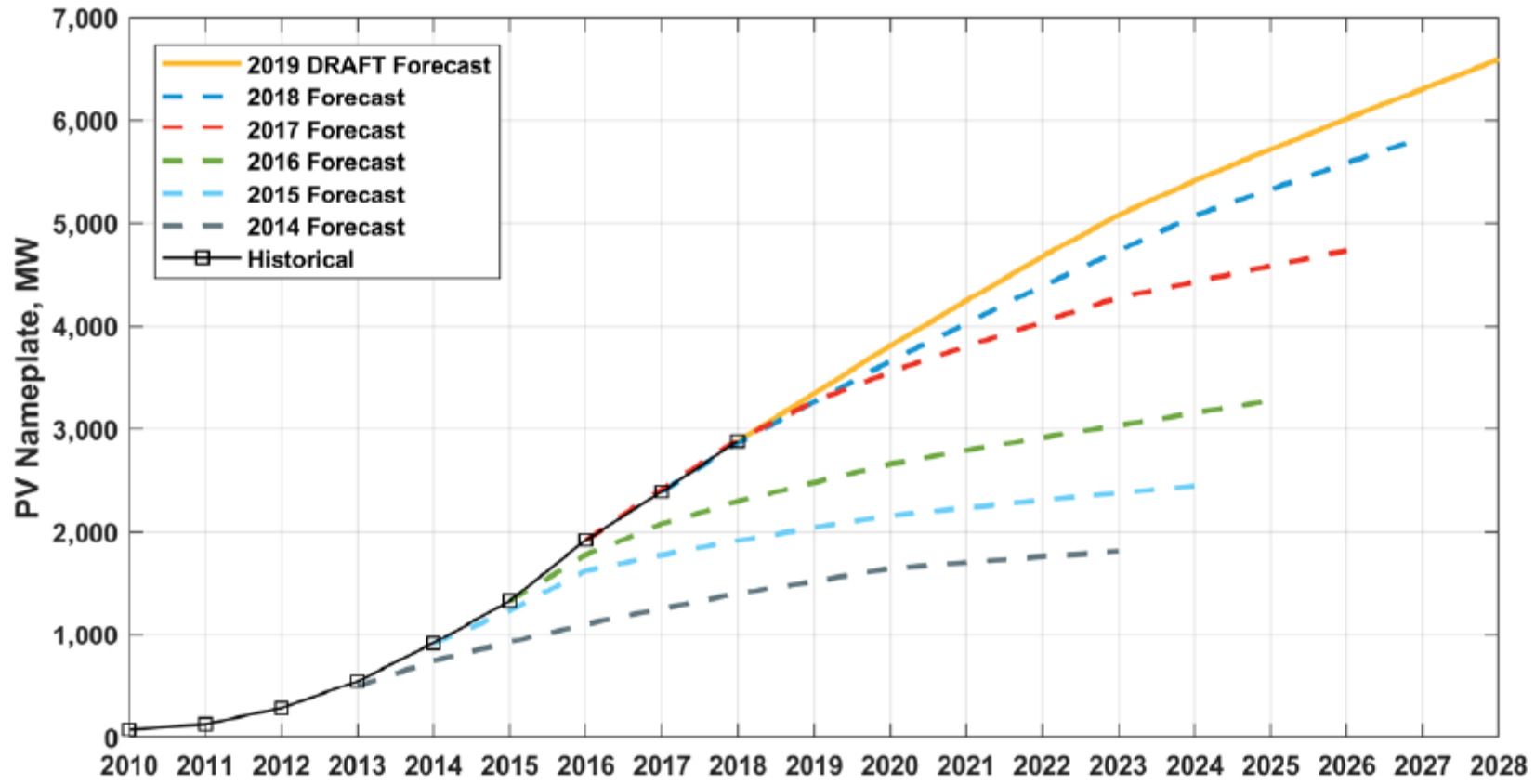
States	Annual Total MW (AC nameplate rating)											Total
	Thru 2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	
CT	464.3	68.4	85.2	77.8	76.4	49.1	47.7	46.3	44.9	43.5	42.1	1,046
MA	1871.3	292.0	288.0	272.0	272.0	272.0	204.0	176.0	170.7	165.3	160.0	4,143
ME	41.4	7.1	7.1	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	109.
NH	83.8	12.7	12.7	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	205.
RI	116.7	51.3	51.3	48.5	42.4	42.4	42.4	42.4	42.4	42.4	42.4	564.
VT	306.3	31.5	22.5	21.3	21.3	21.3	21.3	21.3	21.3	21.3	21.3	530.
Regional - Annual (MW)	2883.8	463.1	466.9	438.3	430.8	403.6	334.2	304.8	298.0	291.3	284.6	6,599
Regional - Cumulative (MW)	2883.8	3346.9	3813.8	4252.2	4683.0	5086.6	5420.8	5725.5	6023.6	6314.9	6599.4	6,599

Notes:

- (1) Forecast values include FCM Resources, non-FCM Energy Only Generators, and behind-the-meter PV resources
- (2) The forecast values are net of the effects of discount factors applied to reflect a degree of uncertainty in the policy-based forecast
- (3) All values represent end-of-year installed capacities
- (4) Forecast does not include forward-looking PV projects > 5MW in nameplate capacity

PV Nameplate Capacity Growth

Historical vs. Forecast



Nameplate PV forecasts cumulative vs. actuals

Year	2014 forecast	2015 forecast	2016 forecast	2017 forecast	2018 forecast	Draft 2019 forecast
2013	36.1					
2014	58.4	81.9			Actuals in red	
2015	74.1	122.2	124.6			
2016	82.8	162.6	154.8	198.4		
2017	91.5	184.9	178.6	223.4	257.2	
2018	100.2	198.7	201.1	248.4	292.2	306.3

- ISO-NE published the first solar PV forecast in 2014
- ISO-NE forecasts have been consistently low
- In the 2014 forecast (published in May)
 - The forecast for Dec 2014 was 58.4 MW, while the actual 2014 installed capacity was 81.9 MW as shown in the 2015 forecast

Nameplate PV forecast shortfalls wrt. actuals

Year	2014 forecast	2015 forecast	2016 forecast	2017 forecast	2018 forecast	Draft 2019 forecast
2013	36.1					
2014	-23.5	81.9				
2015	-50.5	-2.4	124.6			
2016	-115.6	-35.8	-43.6	198.4		
2017	-165.7	-72.3	-78.6	-33.8	257.2	
2018	-206.1	-107.6	-105.2	-57.9	-14.1	306.3

Actuals in red

- Same information as in the prior slide, but showing the differences between the forecasts and the actuals
- Shortfalls are lowering
 - In 2016, the 2016 Solar PV forecast was 44 MW lower than the actual 2016 amount of 198 MW
 - In 2018, the 2018 Solar PV forecast was 14 MW lower than the actual 2018 amount of 306 MW